

Claims

1. A pilot director light (PDL) apparatus mounted on a refueling tanker aircraft for directing a pilot in an approaching aircraft, the device comprising:

one or more light emitting devices, each utilizing a light emitting diode (LED) light source.

2. The apparatus of claim 1, further comprising:

a clear lens covering each of the light emitting devices.

3. The apparatus of claim 2, wherein

each LED light source includes one or more LEDs emitting light at a wavelength of a specific color to be illuminated by the corresponding light emitting device, and

the apparatus includes at least two light emitting devices configured to emit light of different colors.

4. The apparatus of claim 1, wherein each light emitting device is operable to illuminate a symbol.

5. The apparatus of claim 1, the light emitting devices being arranged into first and second assembly strips to provide positional feedback to the pilot,

the light emitting devices in the first assembly strip are configured to provide feedback regarding fore-aft positioning of the approaching aircraft, and

the light emitting devices in the second assembly strip are configured to provide feedback regarding elevation positioning of the approaching aircraft.

6. The apparatus of claim 1, wherein each light emitting device is configured to illuminate a symbol or direction for providing at least one of positional and operational feedback with respect to a refueling operation being performed on the approaching aircraft.

7. The apparatus of claim 1, wherein at least one of the light emitting devices is configured to emit a sheet of light, through a corresponding lens, to the pilot when a fuel receptacle of the approaching aircraft is aligned with a boom envelope associated with the refueling tanker aircraft.

8. The apparatus of claim 7, wherein the at least one of the light emitting devices is configured so that the emitted sheet of light striates as the fuel receptacle moves out of alignment with the boom envelope.

9. The apparatus of claim 1, wherein the LED light source of at least one of the light emitting devices includes,

one or more modules of LEDs, each of the LEDs including a narrow angle emitter for emitting light.

10. The apparatus of claim 9, wherein the narrow angle emitter is configured to emit light, which disperses substantially at an angle of 30 degrees.

11. The apparatus of claim 9, further comprising a mounting structure for each of the first and second strips, each mounting structure including,

a hinged metal cover having openings corresponding to each module; and

a clear lens covering each opening,

wherein the metal cover is configured so that each opening provides a range of illumination through the corresponding clear lens.

12. The apparatus of claim 11, wherein the range of illumination includes an elevational range of substantially -5 and -20 degrees, and an azimuthal range of substantially +15 and -15 degrees, with respect to a longitudinal axis of the refueling tanker aircraft.

13. The apparatus of claim 9, wherein
each module includes multiple rows of LEDs arranged in subsets,
each subset includes one or more LEDs connected in series, and
the subsets of each row are connected in parallel.

14. The apparatus of claim 13, wherein each subset of the module is electrically isolated from faults occurring with respect to other subsets in the module.

15. The apparatus of claim 13, wherein
each module includes 2 rows of LEDs, each row including 12 LEDs,
and
each row is configured to include at least one of: 2 subsets of 6 LEDs, and 3 subsets of 4 LEDs,

16. The apparatus of claim 13, wherein each light emitting device is configured so that any module can be replaced while other modules in the light emitting device are in operation.

17. The apparatus of claim 9, wherein each module can be replaced while other modules are in operation.

18. The apparatus of claim 9, further comprising:

a current control device configured to control the current supplied to each light emitting device.

19. The apparatus of claim 18, wherein the current control device includes,

a dimming control device configured to utilize pulse width modulation (PWM) to conduct dimming of the LEDs in the light emitting device; and

a power supply interface operably connected to a power supply, the power supply interface being configured to generate supply voltages and provide reverse polarity protection for the dimming control device and the light emitting device.

20. The apparatus of claim 19, wherein the current control device includes an electromagnetic interference (EMI) filter arranged between the power supply and the power supply interface.

21. The apparatus of claim 20, wherein the power supply interface is configured to receives a 28 VDC power supply, and generate a dimming supply voltage of substantially 5 VDC for the dimming control device and a module supply voltage of substantially 15 VDC for the light emitting device.